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**Developments
Kendray
Barnsley**

For

Clayfield Construction Ltd

**Ground/Geoenvironmental
Investigation Report**

PC/2017

October 2008

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1 Introduction

At the request of Mr R Darley of Clayfield Construction Ltd a Phase I Geoenvironmental and Geotechnical Assessment (Desk Study) and a Phase II Intrusive Investigation have been undertaken at eight sites in Kendray for the proposed housing developments.

The intrusive investigation was undertaken on 11 September 2008 with a JCB.

Where information has been obtained from Third Parties, no liability can be accepted for the accuracy or completeness of this information.

The investigation only samples a small percentage of the ground within each sites. Actual ground conditions may vary between locations of specific investigation.

No checks were made to determine if Japanese Knotweed is present on the sites.

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2 Details of the Sites

The sites are in the residential area of Kendray approximately 2.0km south east of Barnsley town centre and are:

- 1 Gilbert Grove. The National Grid Reference is 436677, 405549. Figure 2017/1 in Appendix 7 shows the site in detail. The site is a flat area at approximately 70m AOD and currently consists of the base of a demolished domestic garage, tarmac hardstanding and landscaped areas containing trees. The site is surrounded by housing.
- 2 Gerald Road. The National Grid Reference is 436447, 405266. Figure 2017/2 in Appendix 7 shows the site in detail. The site is a flat grassed area at approximately 90m AOD and is surrounded by housing.
- 3 Croft Road. The National Grid Reference is 436496, 405048. Figure 2017/3 in Appendix 7 shows the site in detail. The site is a flat grassed area at approximately 98m AOD and is surrounded by housing.
- 4 Birk Crescent. The National Grid Reference is 436397, 405192. Figure 2017/4 in Appendix 7 shows the site in detail. The site is a flat grassed area at approximately 100m AOD and is surrounded by housing and public open space.
- 5 Swanee Road. The National Grid Reference is 436239, 404968. Figure 2017/5 in Appendix 7 shows the site in detail. The site is a slightly sloping grassed area at approximately 95m AOD and is surrounded by housing and public open space.
- 6 Colley Crescent. The National Grid Reference is 436373, 404928. Figure 2017/6 in Appendix 7 shows the site in detail. The site is a flat grassed area at approximately 100m AOD and is surrounded by housing. There are barriers to the site which prevented access and therefore the trial pits were excavated from the public highway.
- 7 Birch Road. The National Grid Reference is 436724, 405270. Figure 2017/7 in Appendix 7 shows the site in detail. The site is a flat grassed area at approximately 90m AOD and is surrounded by housing and public open space.
- 8 Reginald Road. The National Grid Reference is 436726, 405406. Figure 2017/8 in Appendix 7 shows the site in detail. The site is a flat grassed area at approximately 90m AOD and is surrounded by housing and public open space.

It is proposed to build housing on the sites with gardens and car parking areas.

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3 Geology, Radon and Mining

The Envirocheck 1:10 000 British Geological Survey Maps included in Appendix 1 indicate that the sites are underlain by the Oaks Rocks Sandstone.

Faults are shown north east, west and south of the sites but these are not considered to be near enough to have any possible future influence on the site. No coal seams are shown outcropping in the vicinity of the site.

Radon risk reports dated 6 September 2008 and included in Appendix 2 state that the site does not lie within an area where precautions against radon need to be taken in new properties.

Coal mining reports dated 9, 10 and 24 September 2008 were obtained from the Coal Authority and are included in Appendix 3. Coal has been mined in 12 seams from 150-600m below ground level and the date of the last working is 1976. The site is not in the zone of influence of any present or proposed underground coal workings. Therefore there is no requirement to undertake any precautions against past, present or future mining activity. The reports do not identify the possibility of shallow mine workings.

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4 History of the Sites

Historical Ordnance Survey maps have been obtained from Landmark and examined to trace the past development of the sites of the proposed development. Selected maps are reproduced in Appendix 4.

The following observations were made from the maps:

Map dated 1892	Gilbert Grove-The site is within the grounds of Park House and is surrounded by fields and small woods. Gerald Road-The site is part of an agricultural field and is surrounded by farmland. Croft Road- The site is part of an agricultural field and is surrounded by farmland. Birk Crescent- The site is part of an agricultural field and is surrounded by farmland. Swanee Road- The site is part of an agricultural field and is surrounded by farmland. Colley Crescent- The site is part of an agricultural field and is surrounded by farmland. Birch Road- The site is within the grounds of Birk House and is surrounded by fields and small woods. A small pond appears to be within part of the site. Reginald Road-The site is part of a wooded area within the grounds of Birk House and is surrounded by fields and small woods.
Map dated 1906	Gilbert Grove-The Chapeltown Branch Railway has been built 150m to the north east. Gerald Road-No change. Croft Road-No change. Birk Crescent-No change. Swanee Road-No change. Colley Crescent-No change. Birch Road-The Chapeltown Branch Railway has been built 150m to the north east. Reginald Road- The Chapeltown Branch Railway has been built 250m to the east.
Map dated 1931	Gilbert Grove-No change Gerald Road-Housing has been built to the west of the site. Croft Road-The site is now occupied by, and surrounded by, housing. Birk Crescent-The site is now occupied by housing and there is housing to the north and west. Swanee Road-Housing has been built to the east of the site. Colley Crescent-The site is now occupied by, and surrounded by, housing. Birch Road-No change. Reginald Road-No change
Map dated 1962	Gilbert Grove-The site is occupied by domestic garages and is surrounded by housing. Gerald Road-The site is now occupied by housing and there is housing to the east and south and a church hall on the other side of the road to the north west. Croft Road-No change. Birk Crescent-The site is now surrounded by housing.

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4 History of the Sites (continued)

Map dated 1993

Swanee Road-The site is now occupied by housing. There is housing to the north and west but to the south is public open space.

Colley Crescent-No change.

Birch Road-The site is now occupied by a library with housing to the north and south and public open space to the east.

Reginald Road-The site is a public open space and is surrounded by houses.

Gilbert Grove-No change.

Gerald Road-No change.

Croft Road-No change.

Birk Crescent-No change.

Swanee Road-No change.

Colley Crescent-No change.

Birch Road-Birk House has been replaced with housing accessed from Don Road immediately to the south of the site. The library has been extended.

Reginald Road-No change.

The maps do not indicate any land use on the sites or in the vicinity of the sites that would result in pollution or contamination of the site.

The Environment Agency website does not identify any historic or current landfill site within 250m of the developments. A printout is included in Appendix 4.

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5 Landmark Envirocheck Report

A Landmark Envirocheck report was obtained for the site in September 2008 and is included in Appendix 5.

The following features were recorded within 250m of the sites:

Contemporary Trade Directory Entries-11no (2no retail units, gate manufacturer, stair manufacturer, 2no car repair garage, car dealer, 2no petrol filling stations, 2no cleaning services)

None of the above are considered to be possible sources of contamination.

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6 Hydrogeology

The Envirocheck map included in Appendix 6 records that these sites do not lie in a Groundwater Source Protection Zone.

There are no open watercourses in the immediate vicinity of the sites.

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7 Assessment of Contaminated Land from Desk Top Study

Based on the preliminary Desk Study the site is not considered to be at risk from contamination or pollution.

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8 Details of Intrusive Investigation

The investigation was designed to provide general information on ground and groundwater conditions on the site, together with identifying potential areas of contamination. The investigation was undertaken in accordance with the principles of BS5930:1999 and BS10175:2001 and under the full time supervision of a Chartered Engineer.

The trial pit investigation was undertaken on 11 September 2008 and comprised eighteen trial pits. The trial pit locations and the trial pit details are shown in Appendix 7. Photographs of the trial pits are included in the report.

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9 Details of Soil Conditions

The soil conditions are:

Gilbert Grove- topsoil over stiff clay with sandstone at 1.8m deep.

Gerald Road-topsoil over medium dense sand becoming weathered sandstone with depth.

Croft Road-topsoil/demolition rubble over medium dense sand becoming weathered sandstone with depth.

Birk Crescent-topsoil/demolition rubble up to 1.4m deep over medium dense sand becoming weathered sandstone with depth.

Swanee Road-topsoil over medium dense sand becoming weathered sandstone with depth.

Colley Crescent-topsoil/demolition rubble over firm sandy clay becoming mudstone with depth. (Access was restricted to this site)

Birch Road-topsoil/demolition rubble up to 1.0m thick over either soft blue/grey clay or firm brown clay becoming mudstone with depth.

Reginald Road-topsoil over clay becoming weathered sandstone with depth.

No significant water ingress was encountered. All trial pit sides were stable.

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10 In situ and Laboratory Testing

The soils testing was carried out to BS 1377:1990 Methods of Test for Soils for Civil Engineering Purposes. Testing was carried out by Professional Soils Laboratory Limited of Doncaster and to UKAS accredited procedures. The full results are included in Appendix 87.

Samples were selected from the trial pits on the basis of those that were most likely to be contaminated and those that would give the most appropriate indication of the spread of any contaminants. The samples were stored in plastic containers.

Sample 2 was obtained from trial pit 1 at a depth of 0.3m below ground level, sample 3 was obtained from trial pit 4 at a depth of 0.2m, sample 4 was obtained from trial pit 6 at a depth of 0.3m, sample 5 was obtained from trial pit 8 at a depth of 0.5m, sample 6 was obtained from trial pit 11 at a depth of 0.3m, sample 8 was obtained from trial pit 12 at a depth of 0.3m, sample 9 was obtained from trial pit 15 at a depth of 0.2m and sample 11 was obtained from trial pit 17 at a depth of 0.3m.

Samples 1 and 7 were tested for shrinkage potential.

The aim was to preliminarily characterise the level of any contamination on the site in order to provide an assessment of the risks associated with the contaminant in respect of both human health and the environment, including controlled waters.

The results have been compared to the present Soil Guideline Values (SGV) and Dutch Intervention Values (DIV). The Dutch values have been used where there are no corresponding SGV values. As the proposed development will incorporate domestic gardens the values for residential with plant uptake have been used.

The following results in mg/kg were obtained:

Arsenic-values 8-36, lower than SGV of 20 with the exception of Birk Crescent.
Cadmium-values 0.7-1.3, lower than SGV of 8 (PH=7.5-8.3)
Chromium-values of 13-37, lower than SGV of 130
Copper-values of 14-43, lower than DIV of 190
Lead-values of 22-68, lower than SGV of 450
Mercury-values of 0.4
Nickel-values of 16-23, lower than SGV of 50
Selenium-values <0.5-1.5, lower than SGV of 35
Zinc-values of 64-590, lower than DIV of 720
Boron-values of 1.1-2.0, lower than former ICRL value of 3.0
Thiocyanate-values of 4.9-7.8, lower than DIV of 20
Cyanide-values of 0.1-0.6, lower than DIV of 50
Sulphur-values of <0.8, lower than DIV of 5000
PAH of <5.0-34, lower than DIV of 40
Phenol-values of <0.3

Therefore no values exceed the relevant guide levels except arsenic at Birk Crescent..

No gas testing was undertaken.

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11 Geoenvironmental Risk Assessment

Conceptual Site Model

A quantitative health and environmental risk assessment has been carried out as part of this assessment. The process of risk assessment is set out in Part IIA of the Environment Protection Act 1990 and partly amended The Water Act 2003. This defines contaminated land as 'Any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that there is a significant possibility of significant harm being caused, or that significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.'

The Act introduces the concept of a pollution linkage. This linkage consists of a pollution (contaminative) source or hazard and a receptor, together with an established pathway between the two. For land to be contaminated, a pollution linkage (hazard-pathway-receptor) must exist. This forms a 'conceptual model' of the site.

Examples of pathways and effects from land contamination (after PPS 23) are given below and these are illustrated in Appendix 8.

Human Health (Pathways 1-5)

Uptake of contaminants by food plants grown in contaminated soil-Uptake will depend on concentration in soil, its chemical form, soil pH, plant species and prominence in diet.

Ingestion and inhalation-Substances may be ingested directly by young children playing on contaminated soil, by eating plants which have absorbed metals or are contaminated with soil or dust. Ingestion may also occur via contaminated water supplies. Metals, some organic materials and radioactive substances may be inhaled from dusts and soils.

Skin contact-Soil containing tars, oils and corrosive substances may cause irritation to the skin through direct contact. Some substances (e.g. phenols) may be absorbed into the body through the skin or through cuts and abrasions.

Irradiation-As well as being inhaled and absorbed through the skin, radioactive materials emitting gamma rays can cause a radiation response.

Fire and explosion-Materials such as coal, coke particles, oil, tar, pitch, rubber, plastic and domestic waste are all combustible. Both underground fires and biodegradation of organic materials may produce toxic or flammable gases. Methane and other gases may explode if allowed to accumulate in confined spaces.

Buildings (Pathways 7 and 8)

Fire and explosion-underground fires may cause ground subsidence and cause structural damage. Accumulations of flammable gases in confined space leads to a risk of explosion. Underground fires may damage services.

Chemical attack on building materials and services-Sulphates may attack concrete structures. Acids, oils and tarry substances may accelerate corrosion of metals or attack plastics, rubber and other polymeric materials used in pipework and service conduits or as jointing seals and protective coatings to concrete and metals.

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11 Continued

Physical-Blast furnace and steel making slag may expand. Degradation of fills may cause settlement and voids in buried tanks and drums may collapse as corrosion occurs or under loading.

Natural Environment (Pathway 6)

Phytotoxicity (prevention/inhibition of plant growth)-Some metals essential for plant growth at low levels are phytotoxic at higher concentrations. Methane and other gases may give rise to phytotoxic effects.

Contamination of water resources-Soil has a limited capacity to absorb, degrade or attenuate the effects of pollutants. When this is exceeded, polluting substances may enter into surface and ground waters.

Ecotoxicological effects-contaminants in soil may affect microbial, animal and plant populations. Ecosystems or individual species on the site, in the surface waters or areas affected by migration from the site may be affected.

For any contaminant source identified judgement is used regarding the probability of a pollution linkage occurring and the potential consequences of that linkage. Based on the probability and likely consequences, the overall risk (significance) can be established. The probability of a hazard, combined with its consequences, can be used to assess risk. This forms the Conceptual Site Model.

Potential contamination sources

Soil at Birk Crescent.

Potential pollutants

Arsenic, probably naturally occurring levels in the soil.

Pathways

1-5

Receptors

The principal receptors at the sites are considered to be humans and controlled waters but as there are no potential sources for contamination no remedial measures are considered to be necessary with the exception of Birk Crescent. In this case the arsenic should be capped off in garden areas with a clean layer of topsoil/subsoil. The risk of the site having any significant impact on controlled waters (surface and ground water) is assessed to be low as there are no sensitive surface or ground water receptors close to the site and no measures are considered to be necessary with respect to controlled waters.

The site is considered unlikely to be classified as Contaminated Land in accordance with Part IIA of the Environmental Protection Act.

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12 Recommendations

Foundations

Foundations will consist of:

Gilbert Grove. The clay has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 900mm below ground level but will require localised deepening near the trees in accordance with the NHBC Guideline 'Building Near Trees'. The clay has a medium shrinkage potential. The maximum depth required would be 1.8m below ground level as at this level sandstone will probably be encountered. However if any part of the foundation is sat on the sandstone it will be necessary to deepen all foundations to the sandstone level to avoid differential movement.

Gerald Road. The sand has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 600mm below ground level

Croft Road. The sand has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 600mm below ground level

Birk Crescent. The sand has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 600mm below ground level however the trial pits indicate that the fill material is up to 1.4m deep and therefore it is probable that some deepening of the footings will be required.

Swanee Road. The sand has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 600mm below ground level

Colley Crescent. The clay has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 900mm below ground level but will require localised deepening near the trees in accordance with the NHBC Guideline 'Building Near Trees'. The clay has a medium shrinkage potential and the mudstone will have a low shrinkage potential. However if any part of the foundation is sat in the mudstone it will be necessary to deepen all foundations of that particular plot to the mudstone level to avoid differential movement. The investigation of this site was limited due to problems with access and therefore it is not known if the soil varies across the site.

Birch Road. The firm brown clay has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 900mm below ground level but will require localised deepening near the trees in accordance with the NHBC Guideline 'Building Near Trees'. The clay has a medium shrinkage potential and the mudstone has a low shrinkage potential. However if any part of the foundation is sat in the mudstone it will be necessary to deepen all foundations to the mudstone level to avoid differential movement. The soft blue clay encountered in part of the site is probably from the former pond that occupied part of the site. If this is encountered during excavation it will be necessary to deepen the footings to the firm brown clay below. This may result in some water ingress and temporary pumping of the excavations may be required.

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12 Recommendations (continued)

Reginald Road. The clay has a safe bearing pressure of 100kN/sq m and therefore 600mm wide footings will be satisfactory for normal domestic construction. The footings should be a minimum of 900mm below ground level but will require localised deepening near the trees in accordance with the NHBC Guideline 'Building Near Trees'. The clay has a medium shrinkage potential. The maximum depth required would be 2.2m below ground level as at this level sandstone will probably be encountered. However if any part of the foundation is sat on the sandstone it will be necessary to deepen all foundations to the sandstone level to avoid differential movement

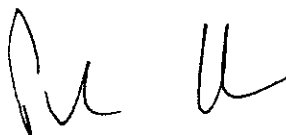
A suspended beam and block floor is preferred for all the sites. This will require a minimum underfloor void of 175mm. However a groundbearing slab could be used on some of the sites where trees or depths of fill are not an issue.

Contamination

No special measures with regard to contamination are considered to be necessary except at Birk Crescent where additional testing of the soil will be required to confirm whether there is a high arsenic content or whether the result was an anomaly. If the soil has a high arsenic content then it is recommended that all garden and landscaped areas are covered with 400mm of clean topsoil/subsoil as a capping layer.

Concrete

Normal grade concrete is considered to be acceptable for these sites.



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Photographs



GILBERT GROVE



GILBERT GROVE



TRIAL PIT 1



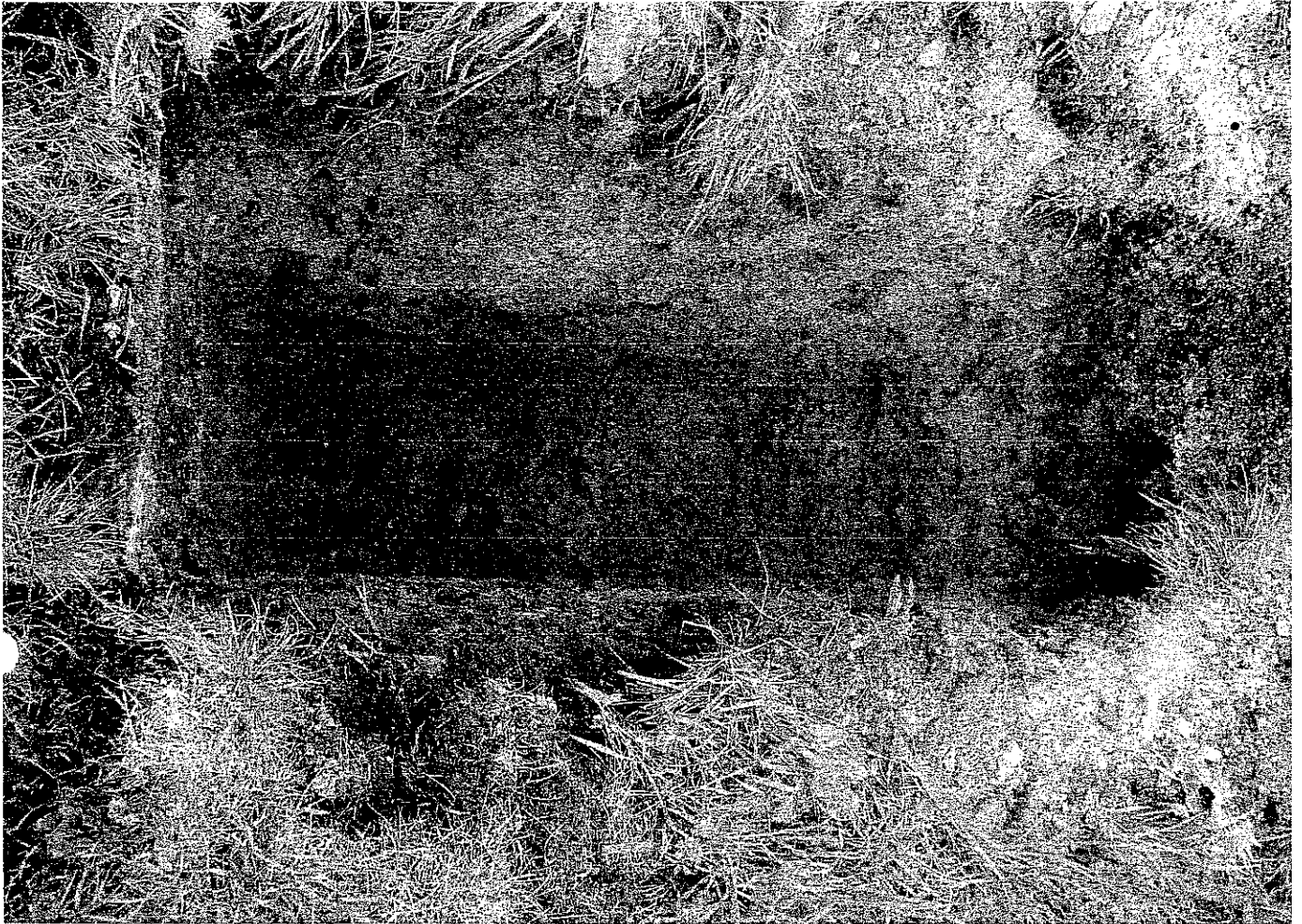
TRIAL PIT 3



GERALD ROAD



GERALD ROAD



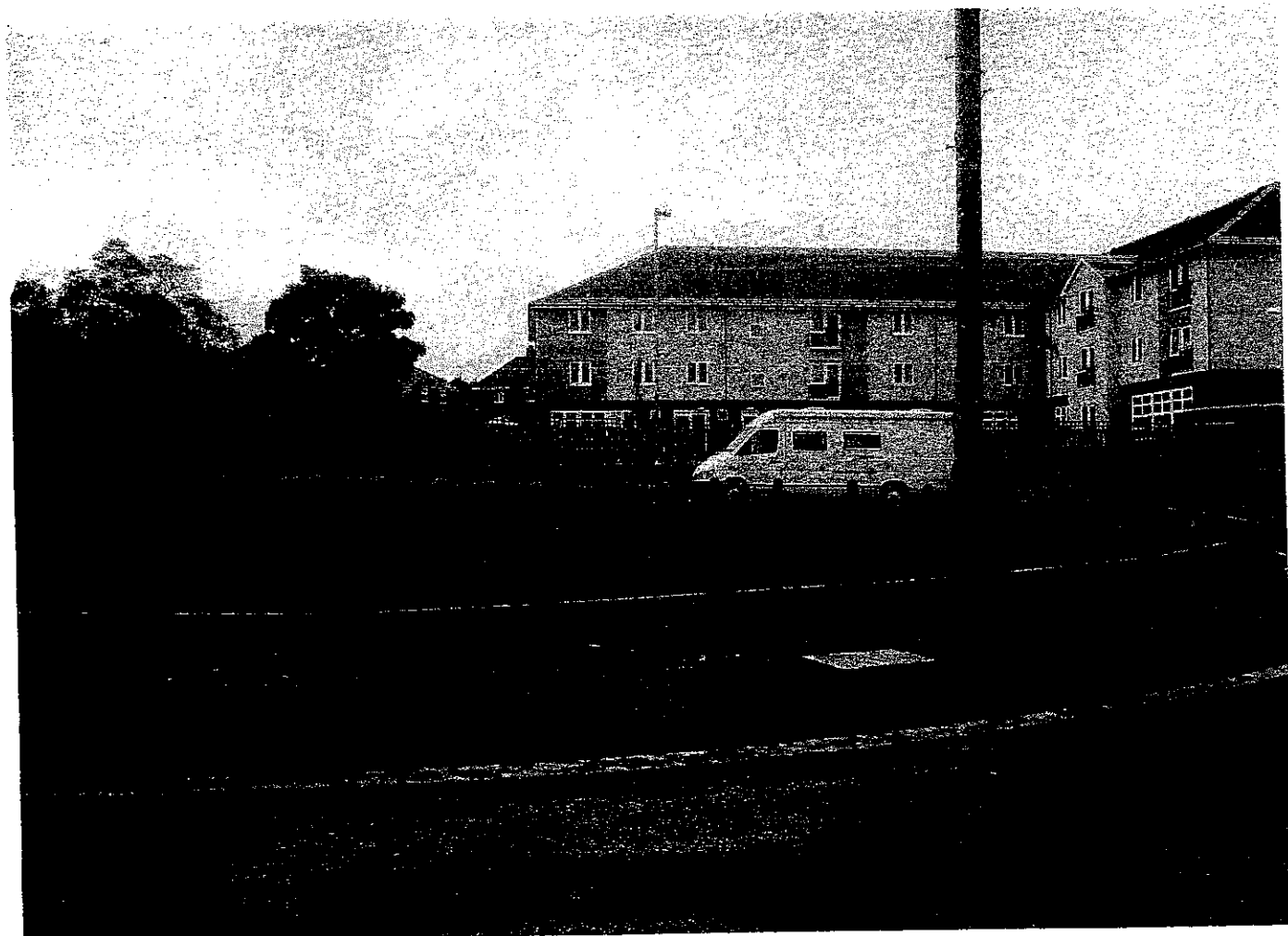
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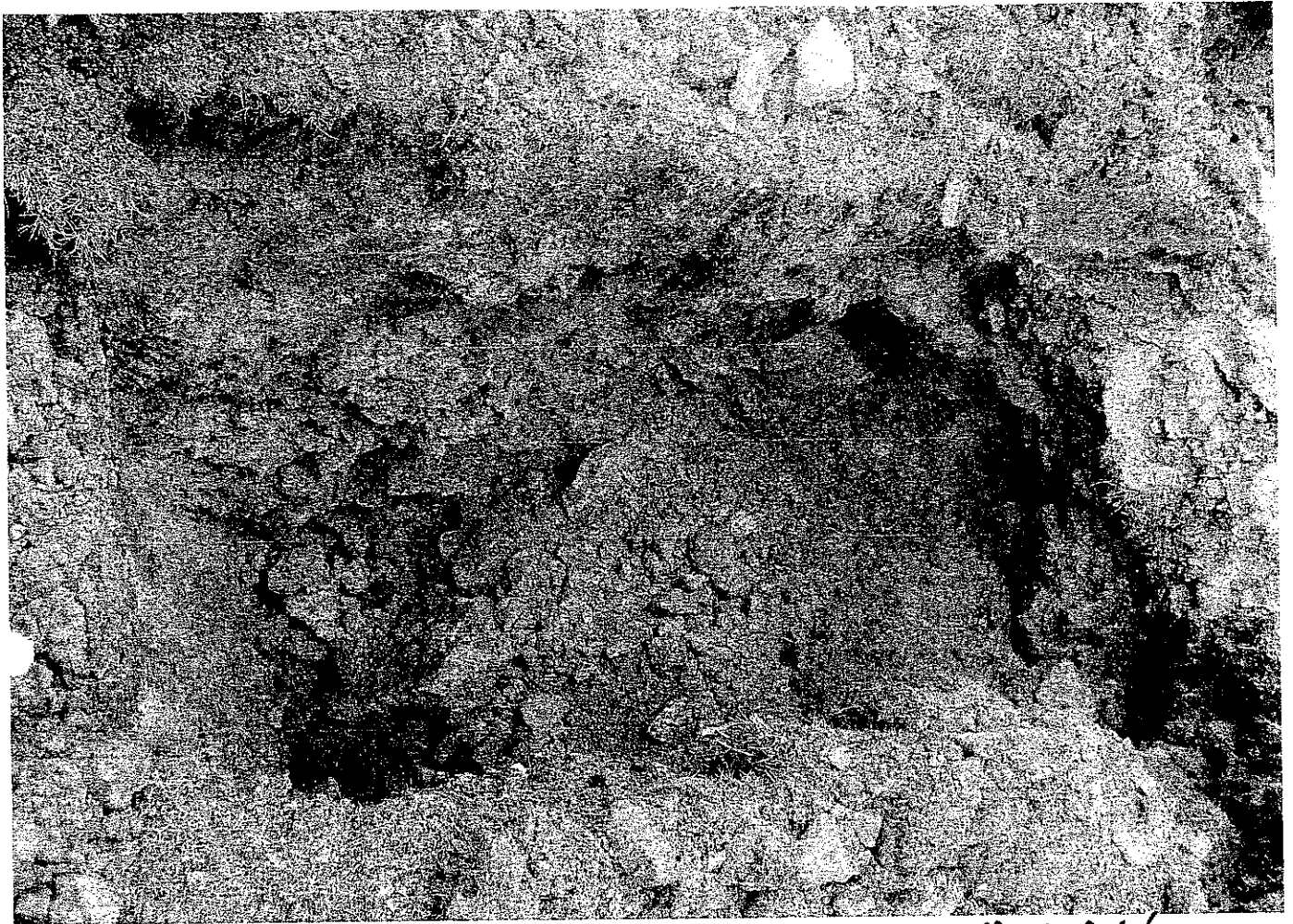
TRIAL PIT 5



CRAFT ROAD



CRAFT ROAD



TRIAL PIT 6



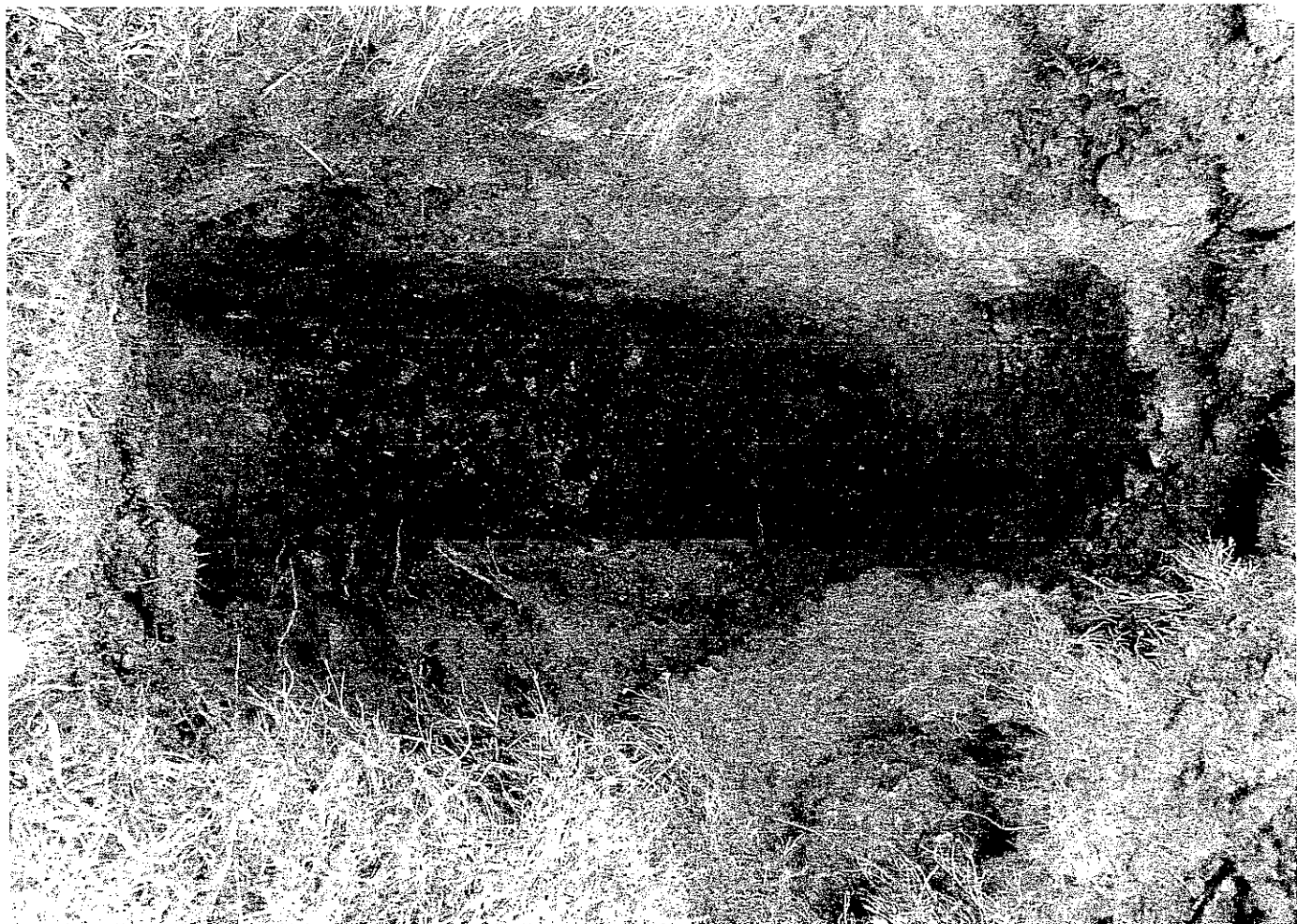
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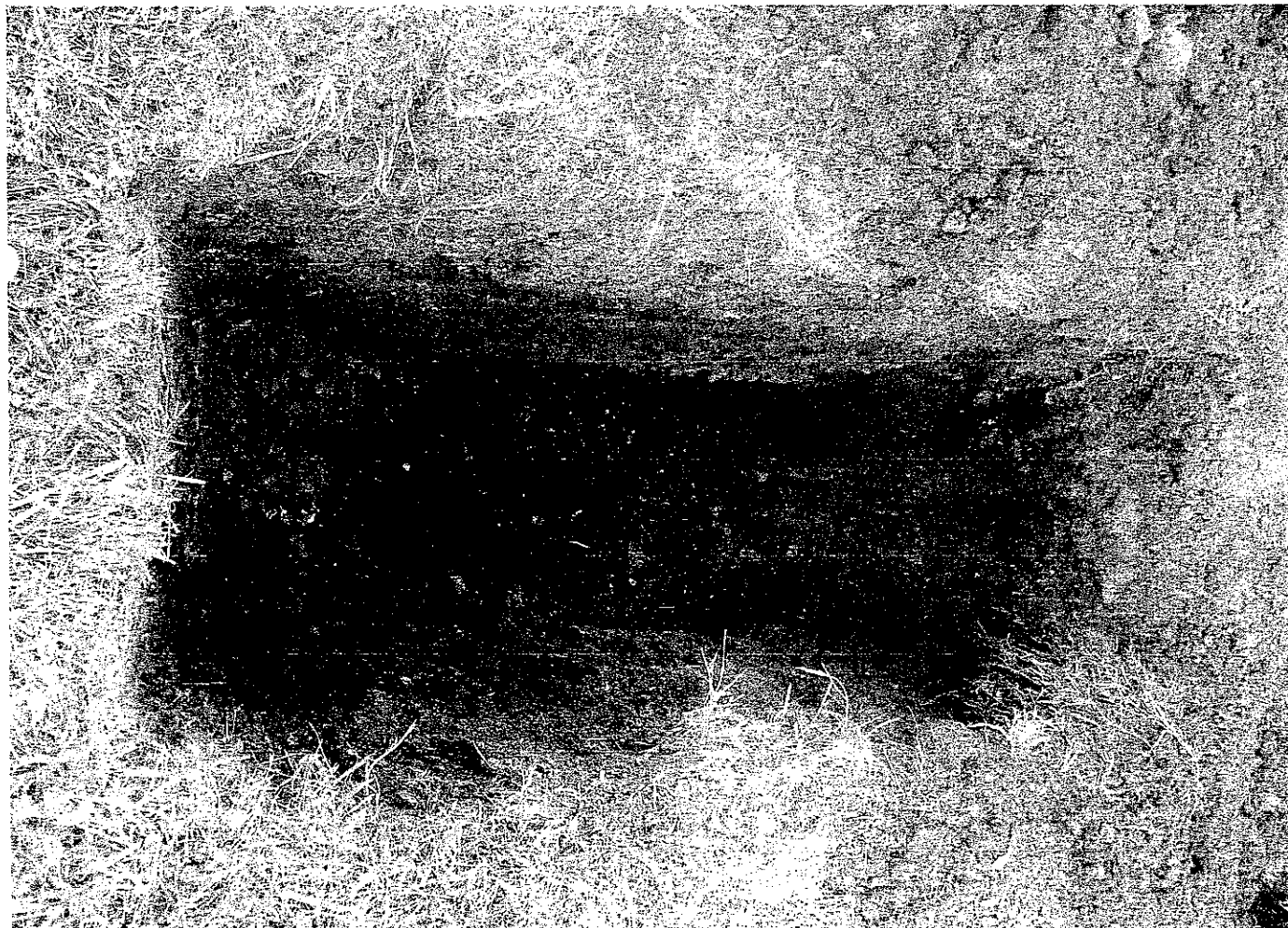
BIRK CRESCENT



BIRK CRESCENT



TRIAL PIT 8



TRIAL PIT 9



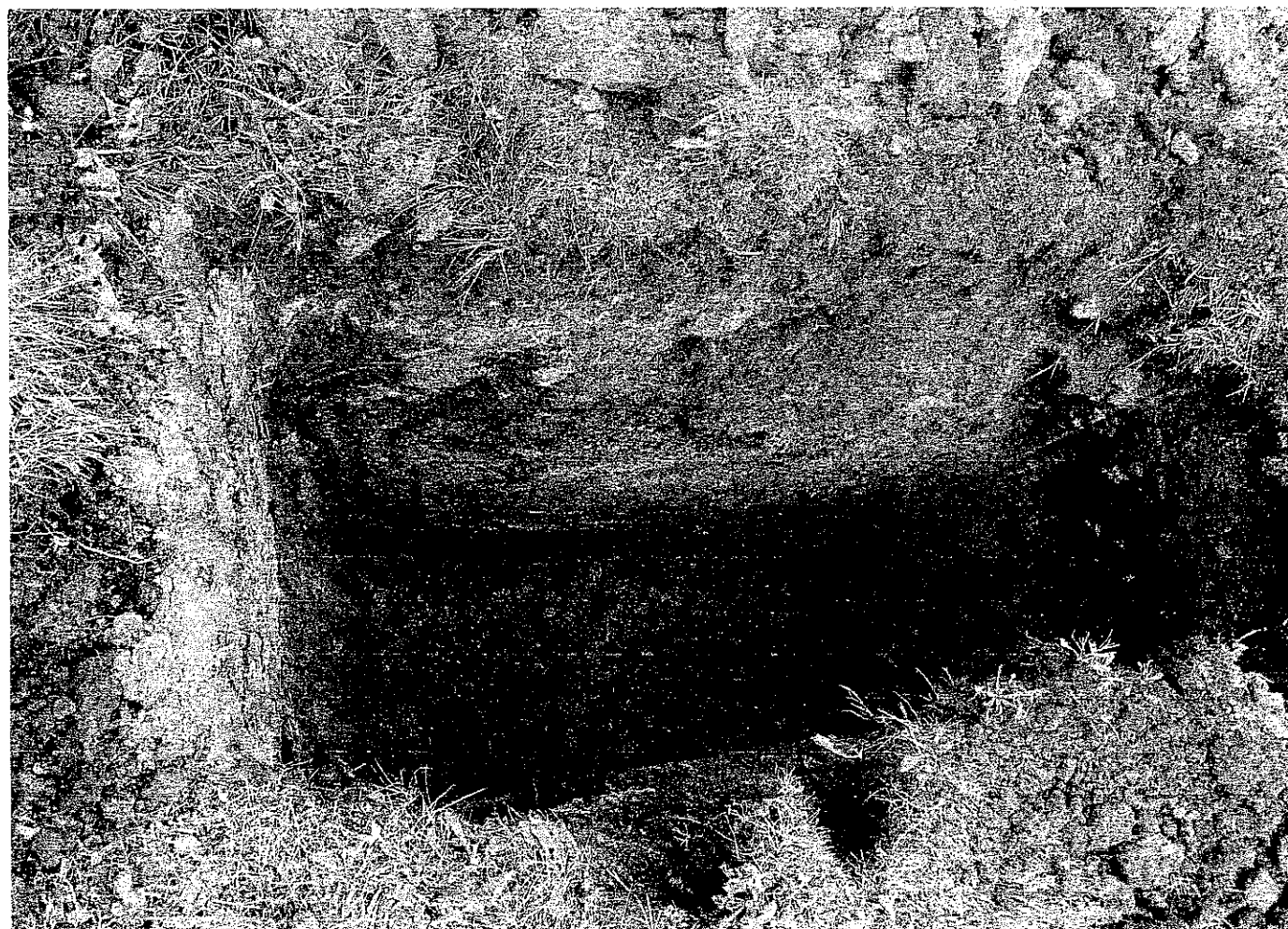
SWANKE ROAD



SWANKE ROAD



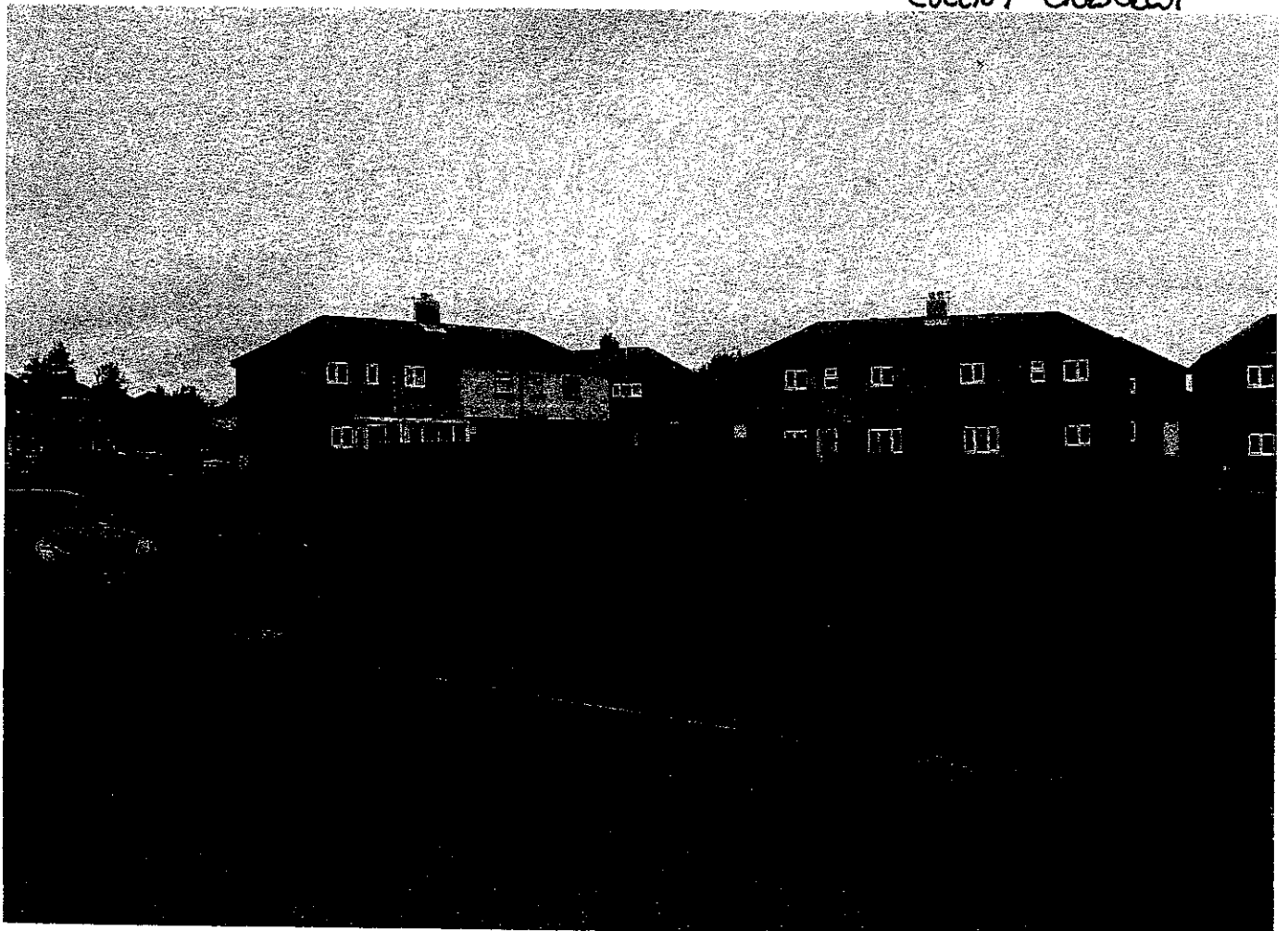
TRIAL PIT 10



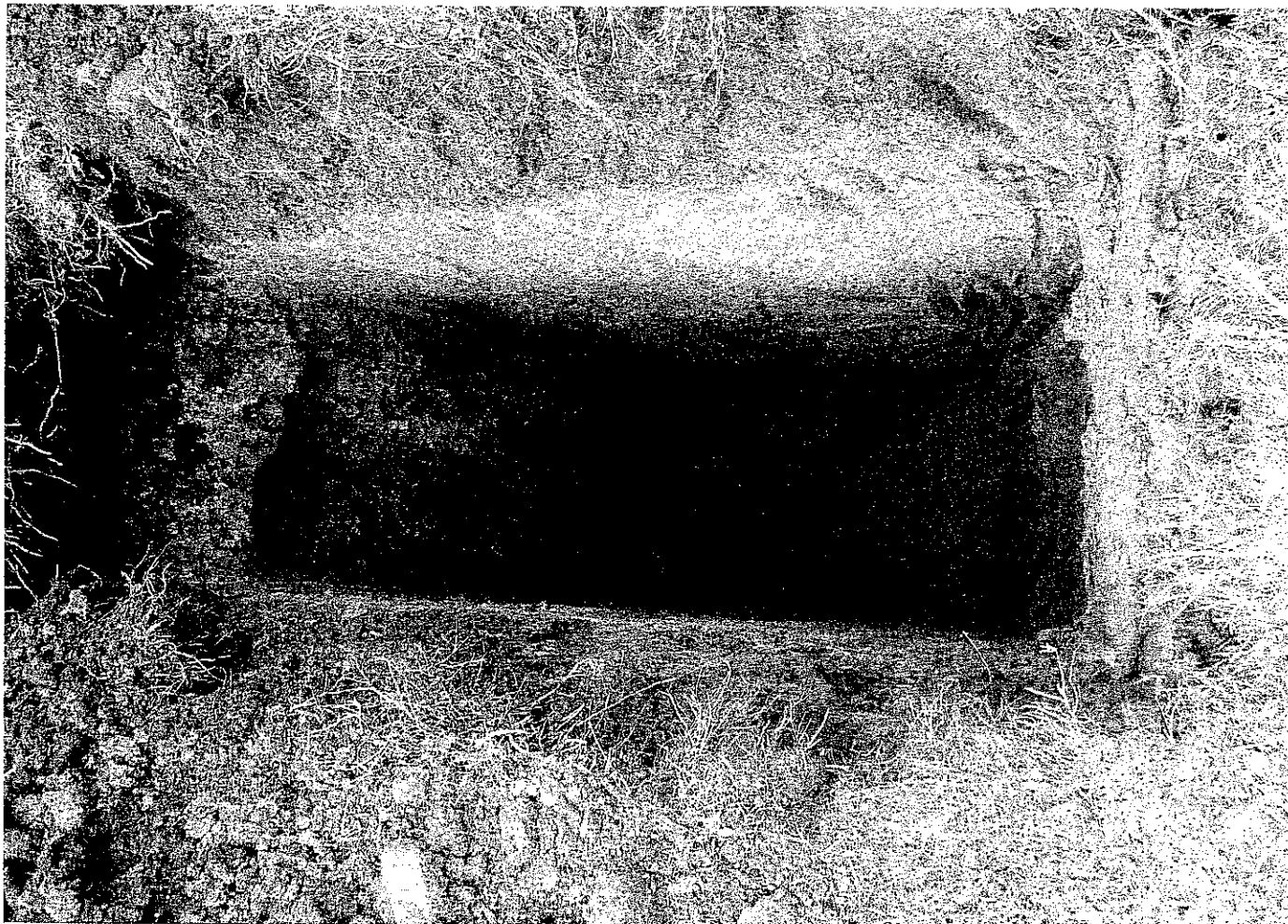
TRIAL PIT 11



COLLEY CRESCENT



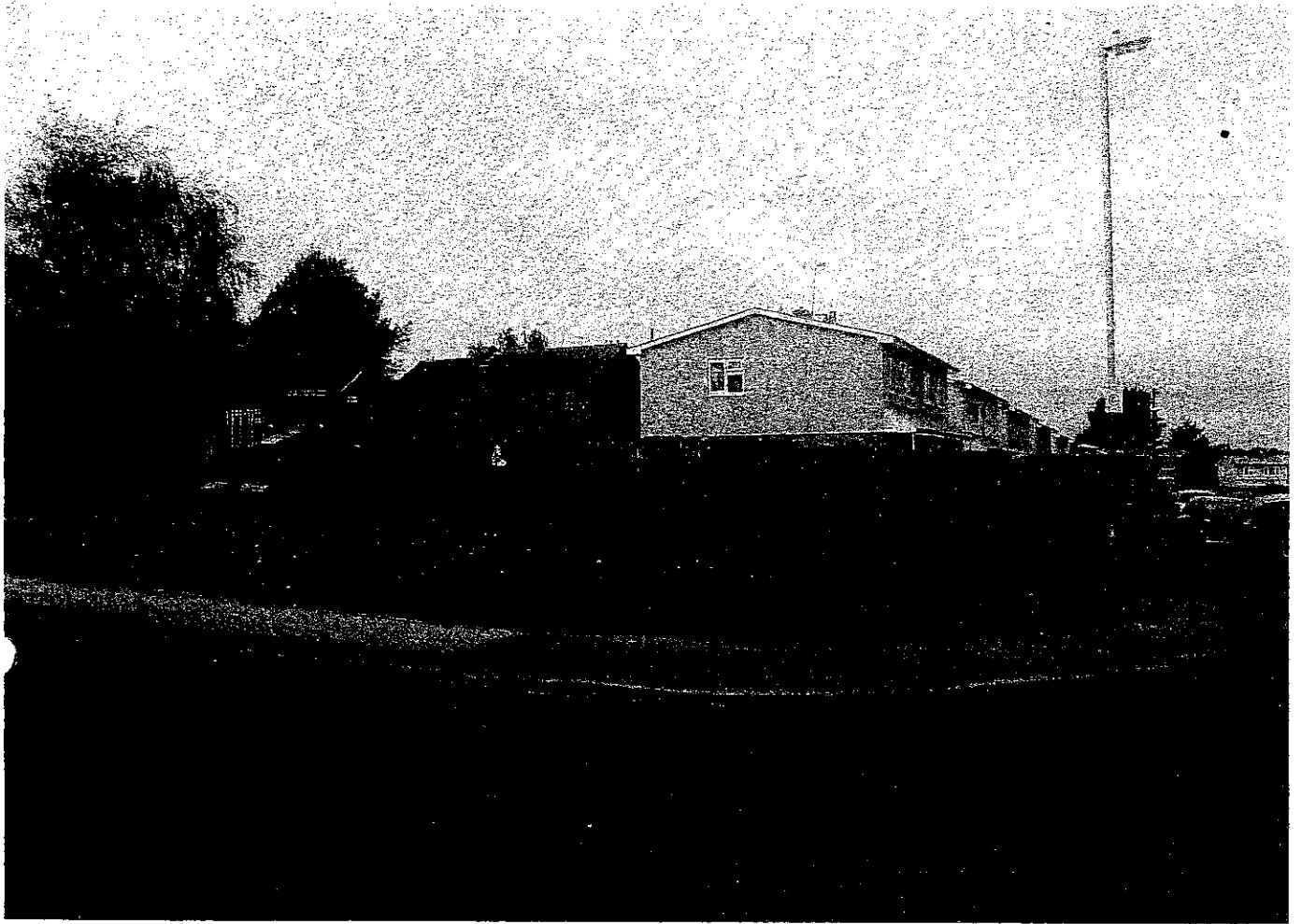
COLLEY CRESCENT



TRIAL PIT 12



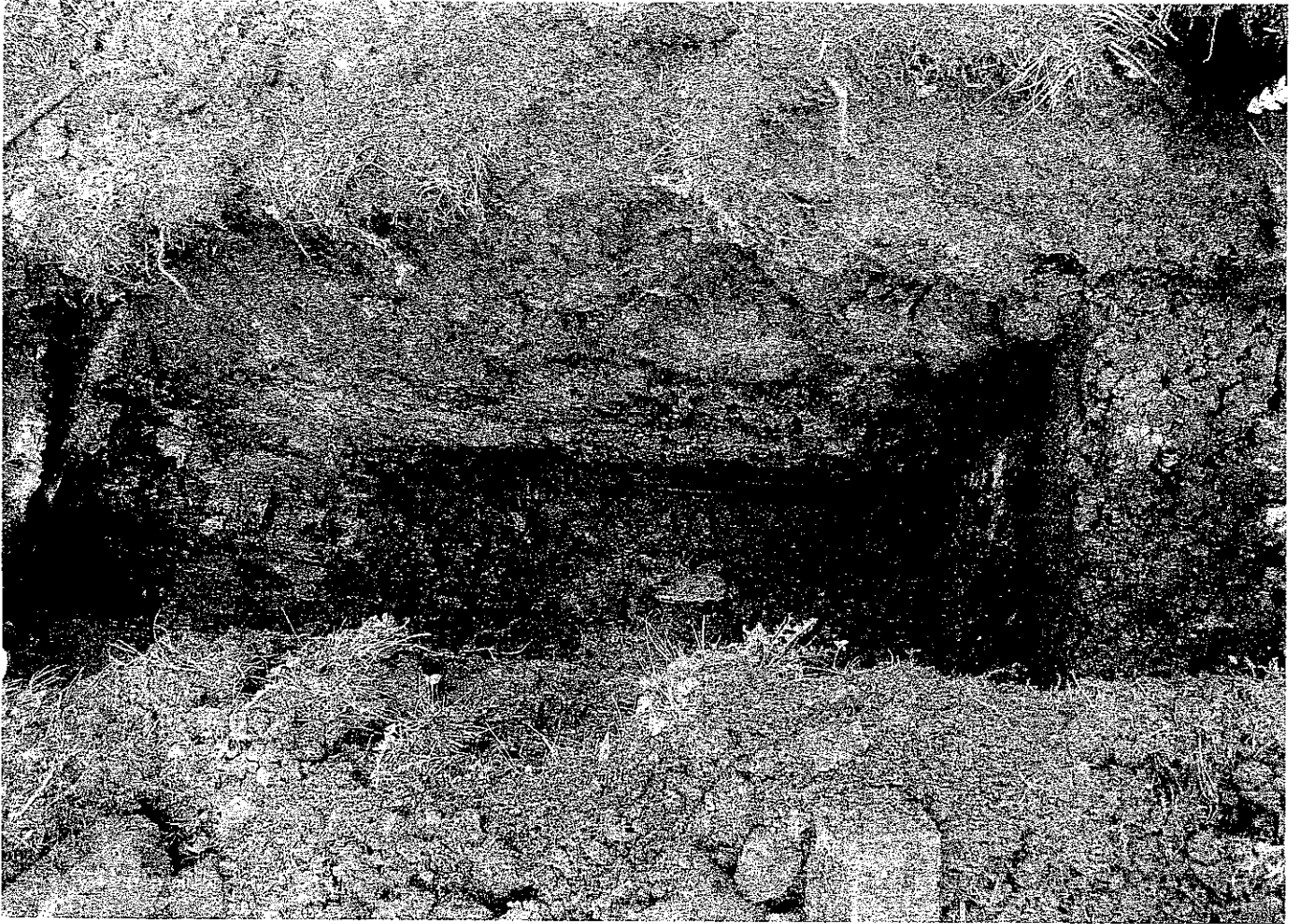
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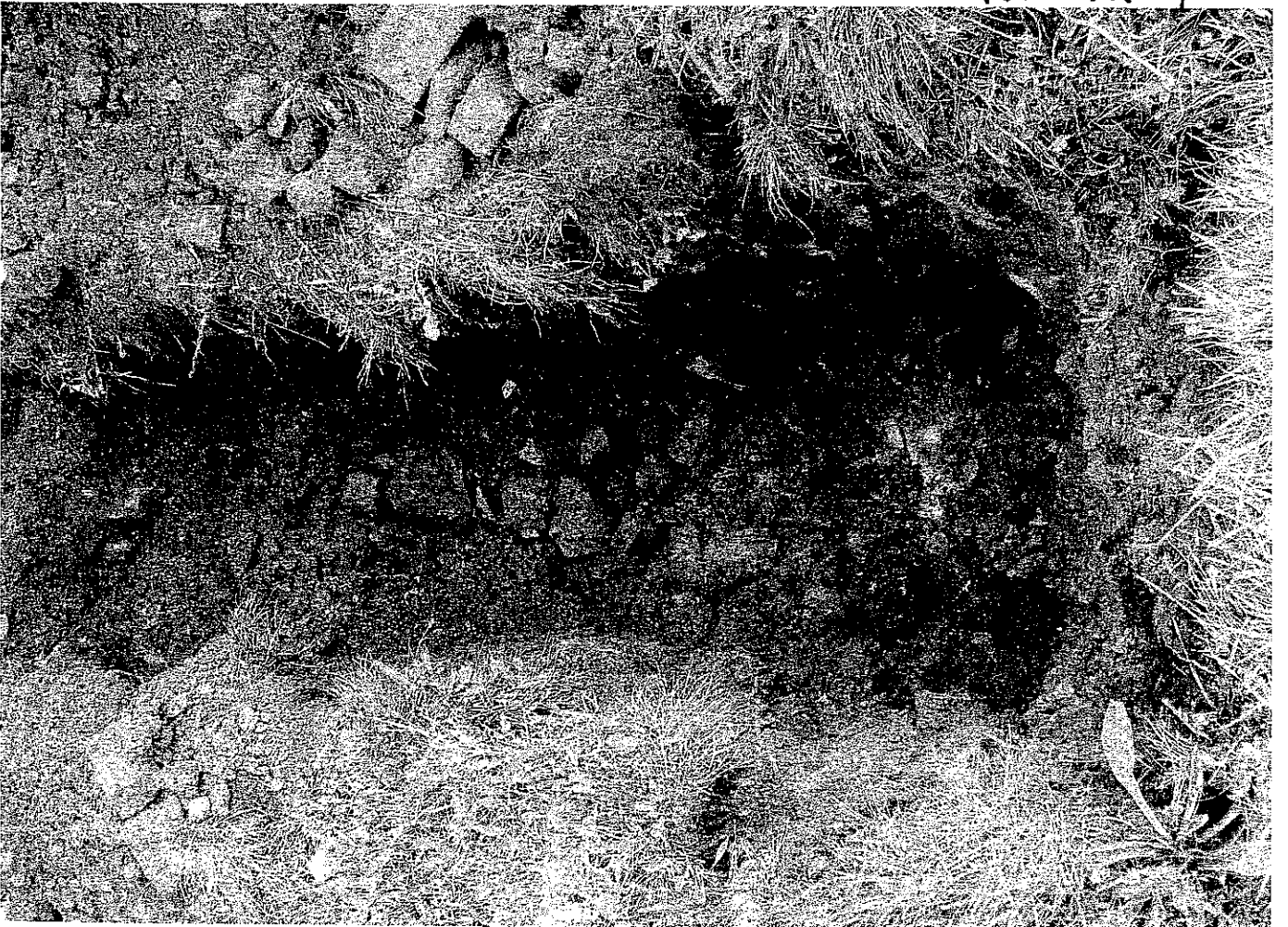
BIRCH ROAD



BIRCH ROAD



TRIAL PIT 14



TRIAL PIT 15



REGINALD ROAD



TRIAL PIT 17